η is a time that a wafer is moved by the robot from Step i to Step j;

$E=\{i|\pi_{iU}>\pi_{Lmax}, i\in \mathbf{N}_4\}$; and

$F=\mathbf{N}_4\backslash E$.

2. The method of claim **1**, further comprising: determining a production cycle of the system.

3. The method of claim **1**, wherein the determination of the robot waiting time is based on a Petri Net model.

4. The method of claim **1**, wherein the h is 2.

5. A non-transitory computer-readable medium whose contents cause a computing system to perform a computer-implemented method for scheduling a cluster tool, the cluster tool comprising a single-arm robot for wafer handling, a wafer-processing system comprising four process modules including PM_1, PM_2, PM_3, and PM_4, each for performing a wafer-processing step with a wafer residency time constraint where the ith process module, $i\in\{1, 2, \ldots 4\}$, is used for performing Step i of the wafer-processing steps for each wafer, and a wafer flow pattern having $(PM_1, (PM_2, PM_3)^h, PM_4)$ with $(PM_2, PM_3)^h$ being the revisiting process and $h\geq 2$, the method comprising:

obtaining, by a processor, a lower bound z_{iL} of a production cycle of Step i, $i\in\{1, 2, \ldots 4\}$, as follows:

$$\pi_{1L}=\alpha_1+3\mu+4\lambda;$$

$$\pi_{2L}=2\alpha_2+\alpha_3+5\mu+8\lambda;$$

$$\pi_{3L}=2\alpha_3+\alpha_2+5\mu+8\lambda; \text{ and}$$

$$\pi_{4L}=\alpha_4+3\mu+4\lambda;$$

obtaining, by a processor, an upper bound π_{iU} of a production cycle of Step i, $i\in\{1, 2, \ldots, 4\}$, as follows:

$$\pi_{1U}=\alpha_1+3\mu+4\lambda;$$

$$\pi_{2U}=2\alpha_2+\alpha_3+5\mu+8\lambda;$$

$$\pi_{3U}=2\alpha_3+\alpha_2+5\mu+8\lambda; \text{ and}$$

$$\pi_{4U}=\alpha_4+3\mu+4\lambda;$$

obtaining, by a processor, a maximum lower bound π_{Lmax} as follows:

$$\pi_{Lmax}=\max\{\pi_{iL}, i\in\mathbb{N}_4\};$$

obtaining, by a processor, a minimum upper bound π_{Umin} as follows:

$$\pi_{Umin}=\min\{\pi_{iU}, i\in\mathbb{N}_4\};$$

determining, by a processor, a robot task time η_1 in a cycle as follows:

$$\eta_1=14\lambda+12\mu+\alpha_2+\alpha_3;$$

determining, by a processor, a robot waiting time ω_i of Step i as follows:

if $[\pi_{1L},\pi_{1U}]\cap[\pi_{2L},\pi_{2U}]\cap[\pi_{3L},\pi_{3U}]\cap[\pi_{4L},\pi_{4U}]\neq\emptyset$ and $\eta_1<\pi_{Lmax}$, then setting $\omega_0=\omega_1=\omega_2=\omega_3=0$, and setting $\omega_4=\pi_{Lmax}-\eta_1$;

else if $[\pi_{1L},\pi_{1U}]\cap[\pi_{2L},\pi_{2U}]\cap[\pi_{3L},\pi_{3U}]\cap[\pi_{4L},\pi_{4U}]\neq\emptyset$ and $\pi_{Lmax}\leq\eta_1\leq\pi_{Umin}$, then setting $\omega_0=\omega_1=\omega_2=\omega_3=0$;

else if $[\pi_{1L},\pi_{1U}]\cap[\pi_{2L},\pi_{2U}]\cap[\pi_{3L},\pi_{3U}]\cap[\pi_{4L},\pi_{4U}]=\emptyset$ and $\pi_{Lmax}\leq\eta_1\leq\pi_{Umin}$, then setting $\omega_i, i\in\Omega_3$ by

$$\omega_{i-1}=\begin{cases}0, & i\in F\\ \pi_{Lmax}-\alpha_i-\delta_i-4\lambda-3\mu, & i\in E\cap\{1,4\}\\ \pi_{Lmax}-2\alpha_2-\delta_2-\alpha_3-5\mu-8\lambda, & i\in E\cap\{2\}\\ \pi_{Lmax}-2\alpha_3-\delta_3-\alpha_2-5\mu-8\lambda, & i\in E\cap\{3\}\end{cases}$$

and setting $\omega_4=\pi_{Lmax}-\eta_1-\sum_{i=0}^{3}\omega_i$;

wherein:

α_i, $i\in\mathbb{N}_4$, is a time that a wafer is processed in the ith process module;

δ_i $i\in\mathbb{N}_4$, is a longest time that a wafer stays in the ith process module after being processed;

λ is a time that a wafer is loaded or unloaded by the robot from Step i;

μ is a time that a wafer is moved by the robot from Step i to Step j;

$E=\{i|\pi_{iU}<\pi_{Lmax}, i\in\mathbf{N}_4\}$; and

$F=\mathbf{N}_4\backslash E$.

6. The non-transitory computer-readable medium of claim **5**, wherein the method further comprises: determining a production cycle of the system.

7. The non-transitory computer-readable medium of claim **5**, wherein the determination of the robot waiting time is based on a Petri Net model.

8. The non-transitory computer-readable medium of claim **5**, wherein the h is 2.

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